ER

maxell

Lithium Thionyl Chloride Battery ($Li/SOCl_2$)

With Terminals and Wire Connectors
(ER18/50 / ER17/50 / ER6 / ER6C / ER17/33 / ER3 / ER3S)

LITHIUM THIONYL CHLORIDE BATTERY

Safety Instructions

This battery is a high energy density sealed battery containing dangerous (Lithium) and deleterious (Thionyl Chloride) materials. For this reason, improper handling of the battery could lead to distortion, leakage*, overheating, explosion, fire, or generation of irritating/corrosive gases, causing bodily injury or equipment trouble. Please observe the following instructions to prevent accidents. For from your customers to your industrial waste processors (including recycled processor), please have them fully understand these instructions.

(* Leakage is defined as the unintentional escape of a liquid from a battery.)

⚠ Warnings Handling

Do not recharge

■Never swallow.

Always keep the battery out of the reach of infants and young children to prevent it from being swallowed. If swallowed, consult a physician immediately.

■Never apply an excessive force to the positive terminal.

Because the positive terminal is sealed by a glass, subjecting this area to sudden jolts and excessive force (over 19.6 N) could destroy the glass seal. This could cause leakage and the generation of irritating/corrosive gases.

■Never drop.

Dropping the battery could destroy the glass seal leading to leakage and the generation of irritating/corrosive gases.

■Never weld the terminals or weld a wire to the body of the battery directly.

The heat of welding or soldering could cause the lithium to melt, or cause damage to the insulating material in the battery, leading to possible distortion, leakage, overheating, explosion, or fire, or generation of irritating/corrosive gases. When soldering the battery directly to equipment, solder only the tabs or leads. Even then, the temperature of the soldering iron must be below 350 deg. C and the soldering time less than 5 seconds. Do not use a soldering bath, because the circuit board with battery attached could stop moving or the battery could drop into the bath. Moreover do not use excessive solder, because the solder could flow to unwanted portions of the board, leading to a short-circuit or charging of the battery.

■Never short-circuit the battery.

Do not allow the positive and negative terminals to short-circuit. Never carry or store the battery with metal objects such as a necklace or a hairpin. Do not take multiple batteries out of the package and pile or mix them when storing. Otherwise, this could lead to distortion, leakage, overheating, and explosion of the battery.

■Never charge.

The battery is not designed to be charged by any other electrical source. Charging could generate gas and internal short-circuiting, leading to distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases.

■Never forcibly discharge.

Forcibly discharging by an external power source or other batteries could cause the voltage to fall below 0V (reversing the poles), generating gas inside the battery and leading to distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases.

■Never heat.

Heating the battery to more than 100 deg. C could increase the internal pressure, causing distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases.

■Never expose to open flames.

Exposing to flames could cause the lithium metal to melt, causing the battery to catch on fire and explode.

■Never disassemble the battery.

Disassembly could generate the irritating/corrosive gases. In addition, the lithium metal inside the battery could overheat, leading to catch on fire.

■Never deform.

Deforming could cause leakage, overheating, explosion, fire, or generation of irritating/corrosive gases.

■Never reverse the positive and negative terminals when mounting.

Improper mounting of the battery could lead to short-circuiting, charging or forced-discharging. This could cause distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases.

■Never use different batteries together.

Using different batteries together, i.e. different type or used and new or different manufacturer could cause distortion, leakage, overheating, explosion, fire, or generation of irritating/corrosive gases because of the differences in battery property. If using two or more batteries connected in series or in parallel even same batteries, please consult with Maxell before using.

■Never allow liquid leaking from the battery to get in your eyes or mouth.

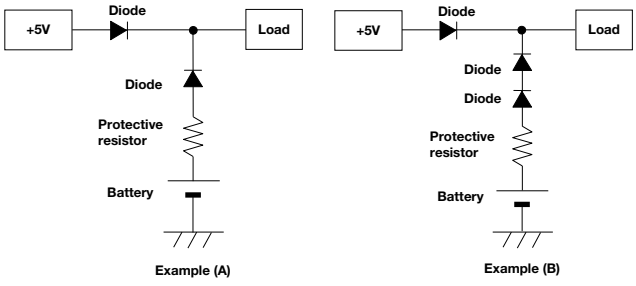
Because this liquid could cause serious damage, if it does come in contact with your eyes, flush them immediately with plenty of water and consult a physician. Likewise, If the liquid gets in your mouth, rinse immediately with plenty of water and consult a physician.

■Never touch the battery electrodes.

Do not allow the battery electrodes to come in contact with your skin or fingers. Otherwise, the moisture from your skin could cause a discharge of the battery, which could produce certain chemical substances causing you to receive a chemical burns.

⚠ Warnings Circuit Design for Back-up Use

This is a primary battery and cannot be charged. If used in memory or RTC back-up applications, be sure to use diodes to prevent charging from the main power source or other batteries, and a protective resistor to regulate the current as shown in the figure below. Note that the points described below should be taken into careful consideration when selecting diodes and protective resistors.



■Supplied voltage to load

Because a diode and a resistor generate the voltage drop on operating, please take into consideration these voltage drops for supplied voltage to load.

■Using diodes to prevent charging

Please choose diodes with leak current of no more than 0.5μA.

Using and setting protective resistors

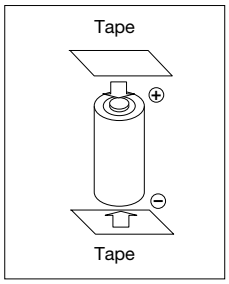
A protective resistor is used to prevent the battery from being charged by large surges of current during diode failure. Please set the resistor so that the maximum current shown in the right table is not exceeded. For example, say an ER6 battery is used in sample circuit A in combination with a main power source 5 volt. Since the permitted charge current is 100µA and this battery's voltage is 3.6V, let the resistor be R≧ (5V-3.6V)/100µA=14k ohm, meaning that at least 14k ohm is required.

Type	Maximum Current
ER18/50	125µA
ER17/50	125µA
ER6	100µA
ER6C	100µA
ER17/33	70µA
ER3	50µA
ER3S	40µA

Note: If the diodes broke down, it is necessary for safety to replace them as soon as possible even though using a protective resistor. Considering the trouble of diodes and resistors, other safety measures should be incorporated in the circuit design.

Warnings Disposal

The battery may be regulated by national or local regulation. Please follow the instructions of proper regulation. As electric capacity is left in a discarded battery and it comes into contact with other metals, it could lead to distortion, leakage, overheating, or explosion, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.



(Example of battery insulation)

Caution Handling

Minimum transient voltage

The various tests have shown that the minimum transient voltage is influenced greatly by the actual conditions of use and storage Therefore, please design your circuits using no more than the standard discharge current, taking into account the voltage drop due to the minimum transient voltage. Please consult with Maxell beforehand if you are unsure of anything.

Installing, removing, and disposing of batteries

1) When installing a battery in a device, make sure that the positive terminal is facing up, or at least to the side. As this battery uses liquid thionyl chloride as the positive active material, placing the positive terminal at the bottom will cause the thionyl chloride to become maldistributed, which could prevent the needed performance from being obtained when a large amount of current is used.

2) Please have the installation, removal, and disposal of this battery performed by a technician with a thorough understanding of the Warnings and Cautions on handling.

Storage

Avoiding storing the battery in direct sunlight, or in excessively hot and humid locations, and store it out of the way of rainwater and other adverse environmental elements.

Bundling

When bundling the battery with a product, be sure to use cushioning and other packing to protect the battery (and especially the positive terminal) from jolts and shocks during transportation.

The ER battery is for industrial use only.
When replacement is necessary, please contact the manufacturer of your equipment.

Overview

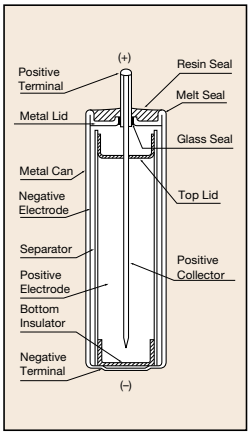
This battery is ideal for such long-term applications as power for electronic devices and electric power, water, and gas meters, and especially as a backup power source for memory ICs.

Products

Model		ER18/50	ER17/50	ER6	ER6C	ER17/33	ER3	ER3S
Nominal Voltage (V)		3.6	3.6	3.6	3.6	3.6	3.6	3.6
Nominal Capacity (mAh)**		3,650	2,750	2,000	1,800	1,600	1,100	790
Nominal Discharge Current (µA)		125	125	100	100	75	40	35
Operating Temperature Range (deg. C)		–55 to +85	–55 to +85	–55 to +85	–55 to +85	–55 to +85	–55 to +85	–55 to +85
Dimensions*	Diameter (mm)	18	17	14.5	14.5	17.0	14.5	14.5
	Height (mm)	52.6	52.6	53.5	51	35	29.9	26
Weight (g)*		22	20	15	15	13	8	7

* Dimensions and weight are for the battery itself, but may vary depending on terminal specifications and other factors.
** Nominal capacity indicates duration until the voltage drops down to 3.0V when discharged at a nominal discharge current at 20 deg. C.
• Data and dimensions are just reference values. For further details, please contact your nearest Maxell dealer or distributor.

Construction



Principle and Reactions

The lithium thionyl chloride battery uses liquid thionyl chloride ($SOCl_2$) as its positive active material, and lithium (Li) as its negative active material. The reactions of the battery are shown below.

■Battery Reactions

Positive reaction: $2SOCl_2+4Li^++4e^-\rightarrow 4LiCl+S+SO_2$

Negative reaction: $Li\rightarrow Li^++e^-$

Total reaction: $2SOCl_2+4Li\rightarrow 4LiCl+S+SO_2$

Features

■High 3.6-V voltage
The lithium thionyl chloride battery achieves a high voltage of 3.6 V.

■Flat discharge characteristics
The change of internal resistance during discharge is minimal, allowing for flat discharge voltage until end of discharge life.

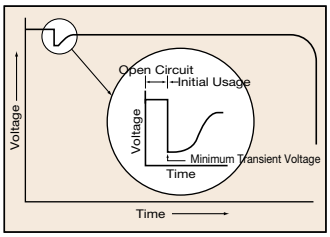
■High energy density
Provides high energy density of 970m Wh/cm^3 with discharge current of 100µA (ER6 type).

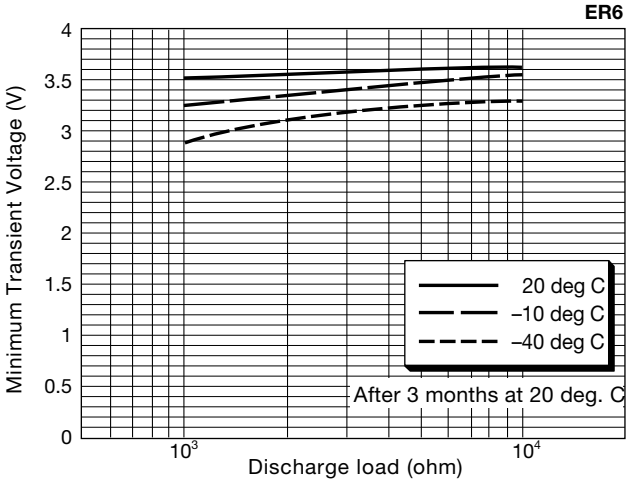
■Wide usable temperature range
Can be used over a wide temperature range : - 55 deg. C to +85 deg. C (please consult with Maxell if using in temperatures of -40 deg. C or less).

■Superior long-term reliability
The extremely low self-discharge, together with the use of a hermetic seal, allows for stable use over long periods.

Minimum transient voltage

The lithium thionyl chloride battery has remarkably lower self-discharge when compared with conventional batteries. This is because a lithium chloride membrane is formed over the negative lithium surface, blocking reaction with the positive material. When first discharging after storage, resistance from this lithium chloride membrane may temporarily reduce the voltage at the initiation of discharge. The lowest voltage at this time is called minimum transient voltage, and the lower the temperature, and the larger the discharge current, the lower the voltage will be. Because minimum transient voltage is greatly influenced by storage time and conditions, it is necessary to take this into sufficient consideration when designing a device.

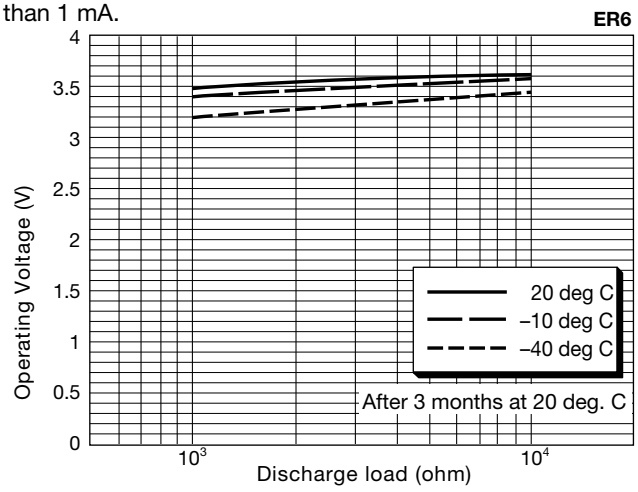




The figure above shows minimum transient voltage using a fresh battery.

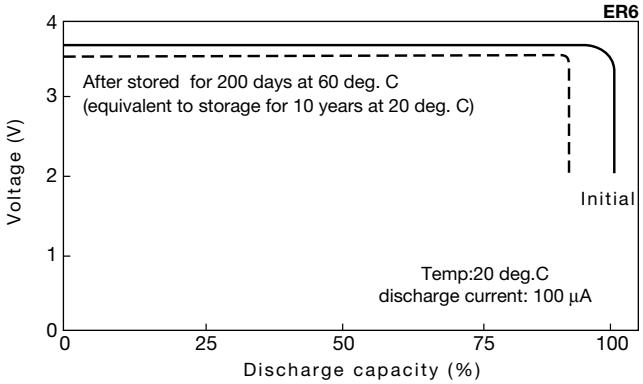
Relationship between Discharge Load and Operating Voltage

The operating voltage of a battery falls as the discharge load increases and temperature falls. In the case of initial use, an electric potential of at least 3 V will be maintained even at temperatures of -40 deg. C at discharge of less than 1 mA.



Storage Characteristics

The lithium thionyl chloride battery is made from chemically stable inorganic materials. Additionally, a sealing method employing a laser-welded seal structure and hermetic seal hinders the admittance of outside air. These features provide superior storage characteristics, holding down self-discharge to no more than 1% of capacity per year at normal temperatures.



UL Recognized Components

The lithium thionyl chloride battery is a UL (Underwriters Laboratories Inc.) recognized component. (Technician Replaceable)

Recognized models: ER18/50, ER17/50, ER6, ER6C, ER17/33, ER3, ER3S

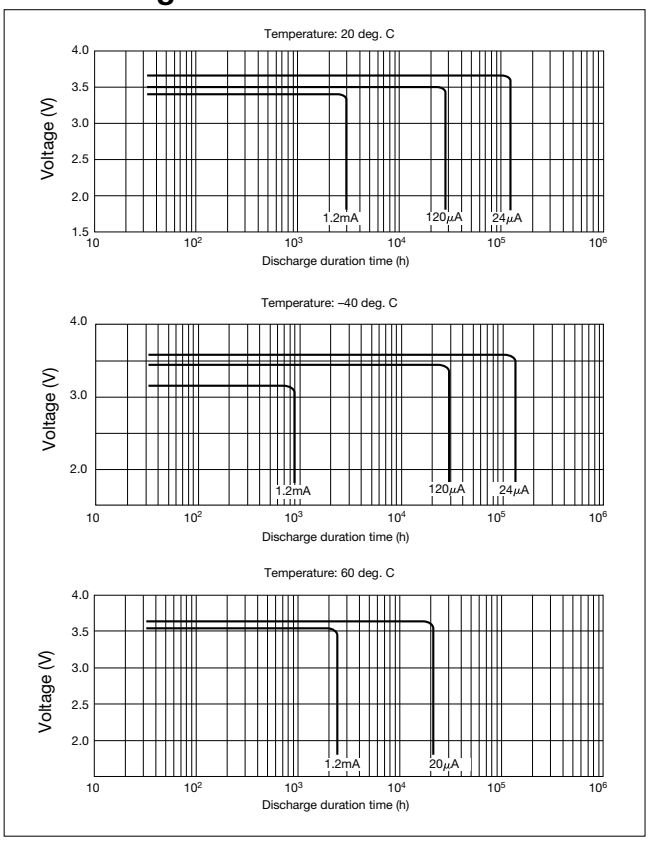
Certification Number: MH12568

Applications

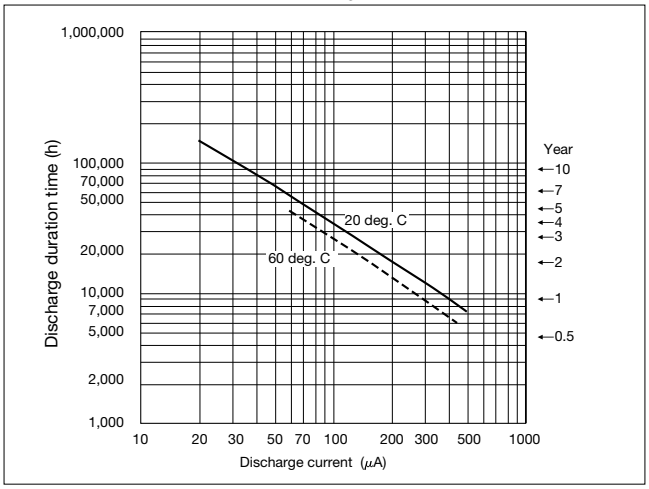
- OA Machines (Fax, Copiers, Printers)
- Desktop PCs ● PDAs
- Medical Instruments, Cash Registers
- FA Instruments (Measuring Instruments, Onboard Microcomputers, Sensors)
- Electronic Meters (Water, Gas, Electricity)
- ETC (Electronic Toll Collection System)

ER18/50 (3650mAh)

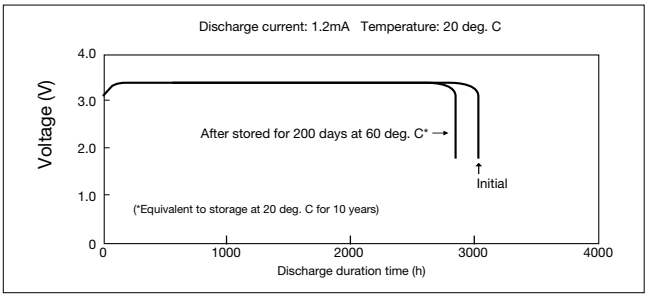
Discharge Characteristics



Relationship between Discharge Current and Duration Time

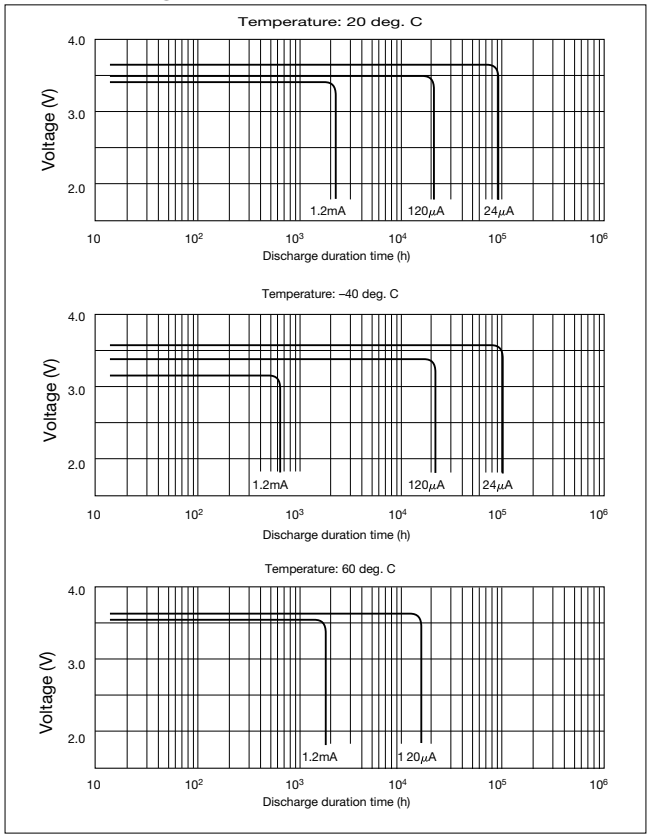


Storage Characteristics

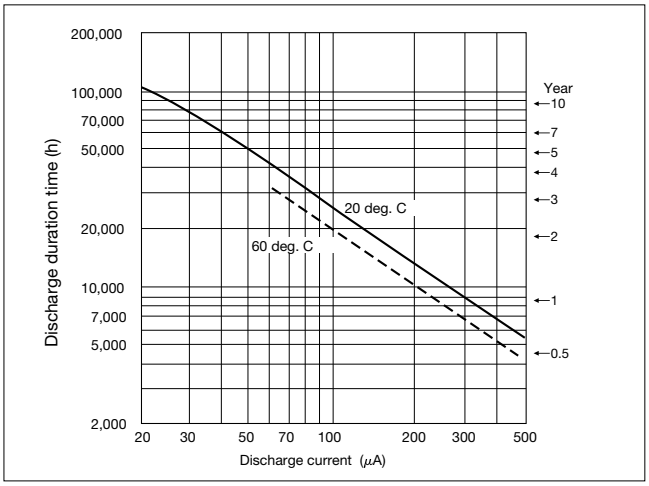


ER17/50 (2750mAh)

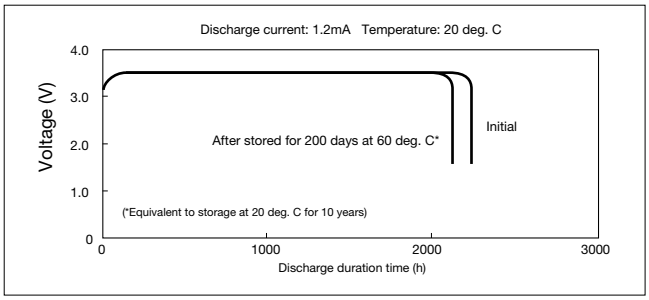
Discharge Characteristics



Relationship between Discharge Current and Duration Time

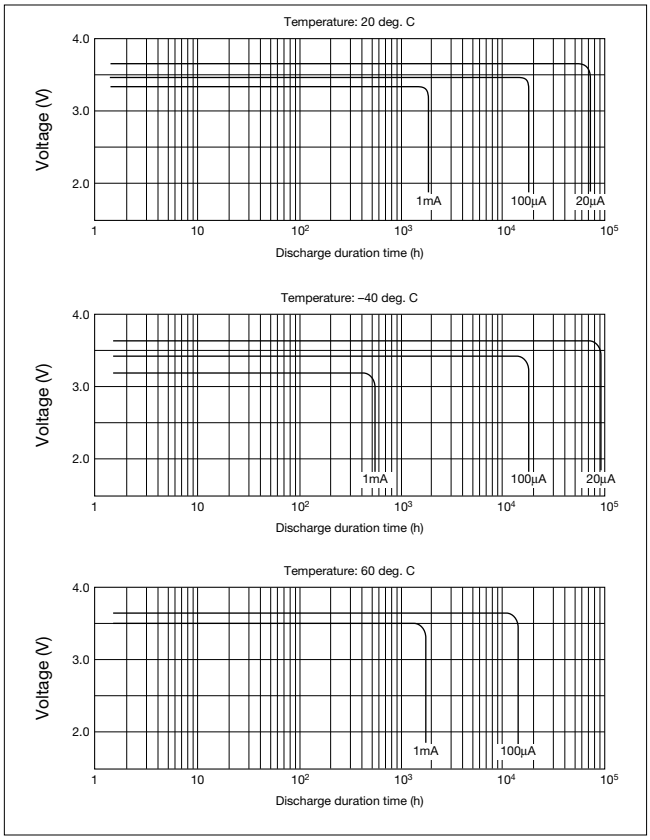


Storage Characteristics

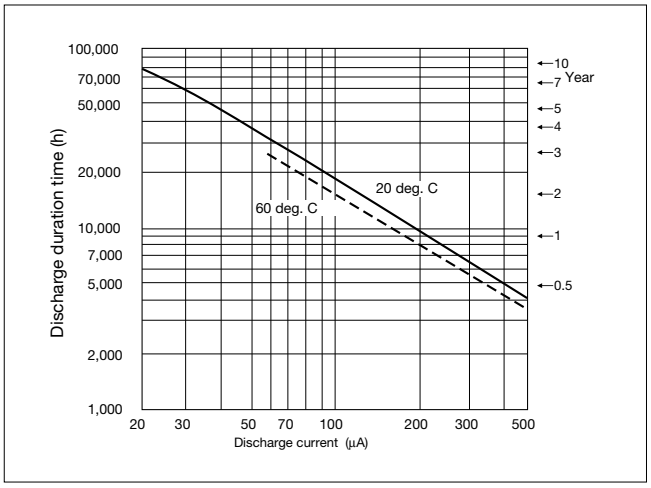


ER6 (2000mAh)

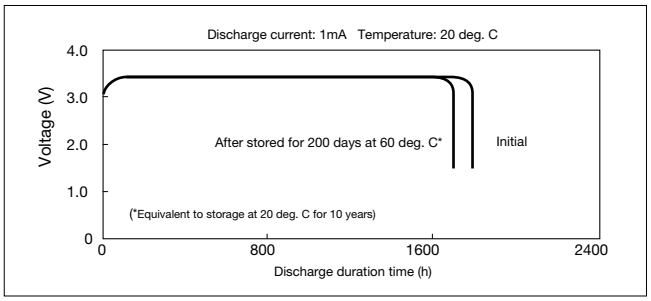
Discharge Characteristics



Relationship between Discharge Current and Duration Time

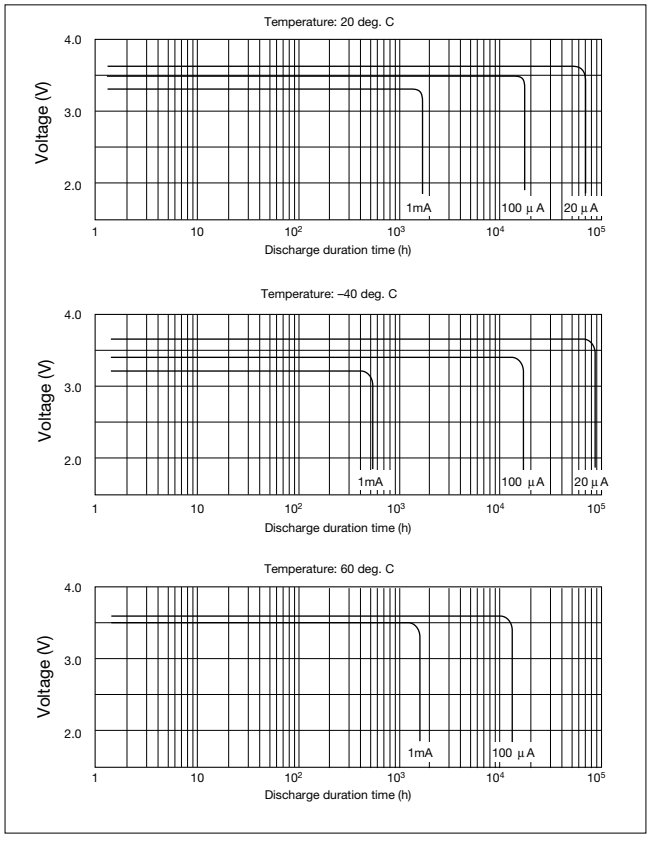


Storage Characteristics

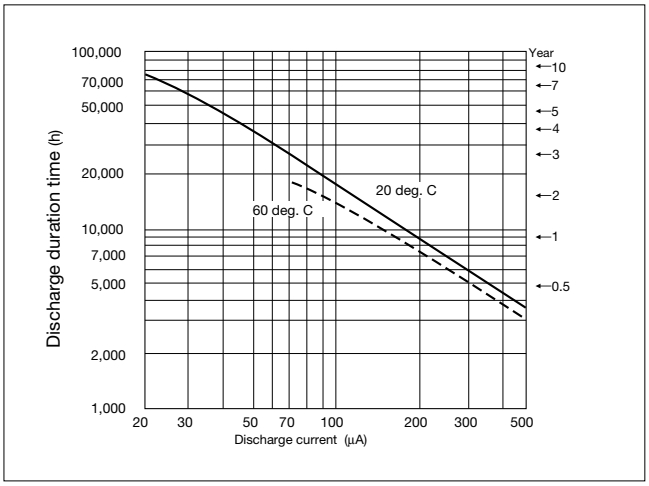


ER6C (1800mAh)

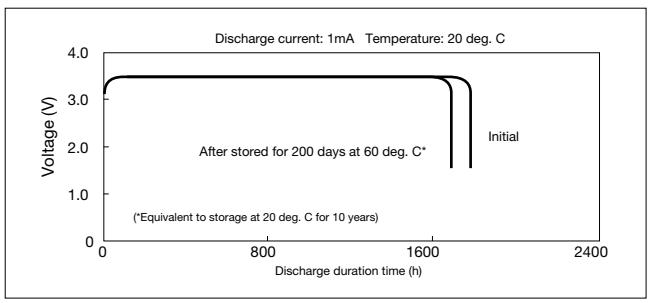
Discharge Characteristics



Relationship between Discharge Current and Duration Time

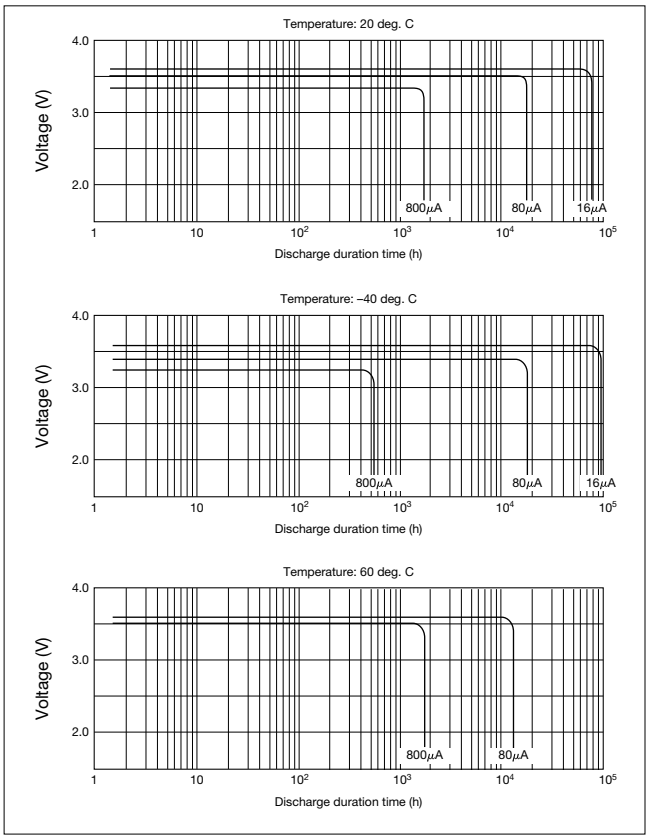


Storage Characteristics

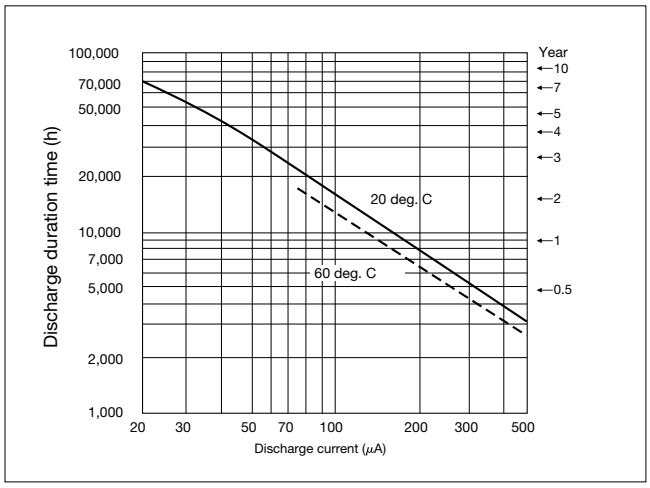


ER17/33 (1600mAh)

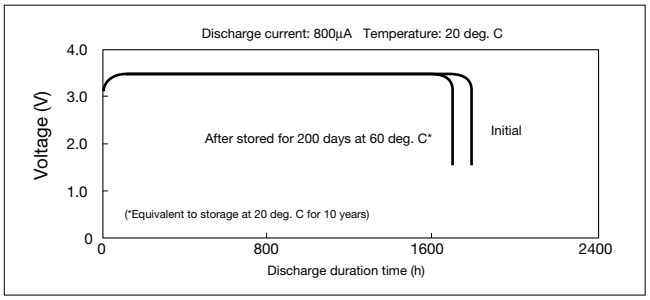
Discharge Characteristics



Relationship between Discharge Current and Duration Time

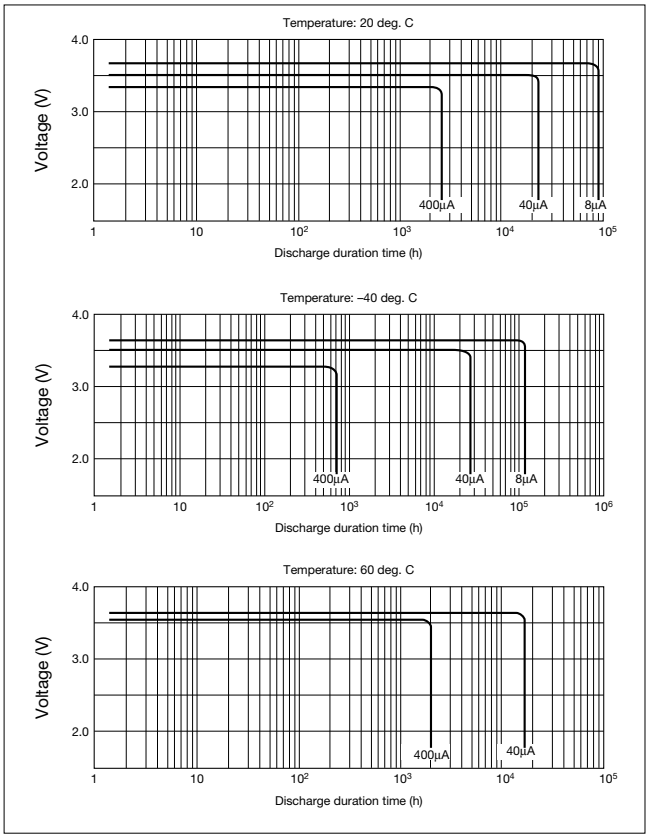


Storage Characteristics

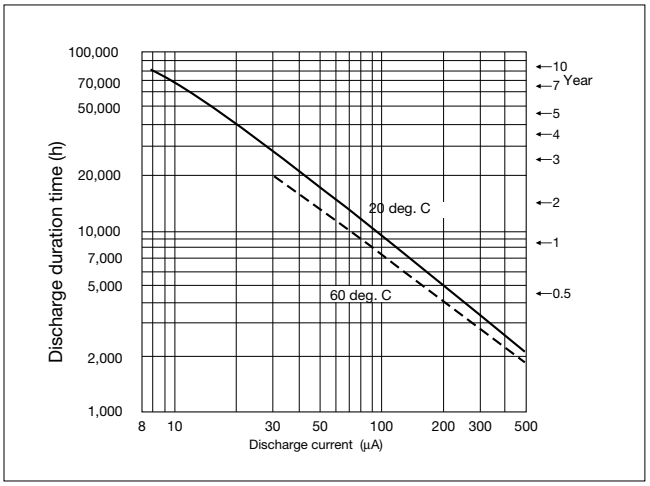


ER3 (1100mAh)

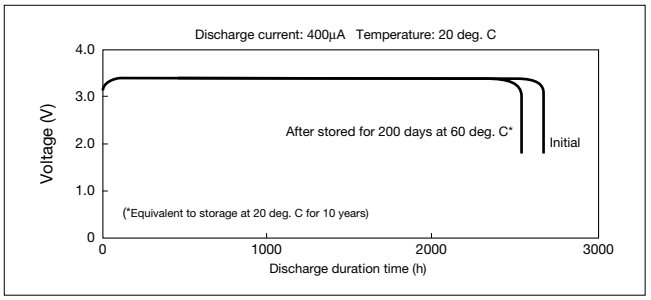
Discharge Characteristics



Relationship between Discharge Current and Duration Time

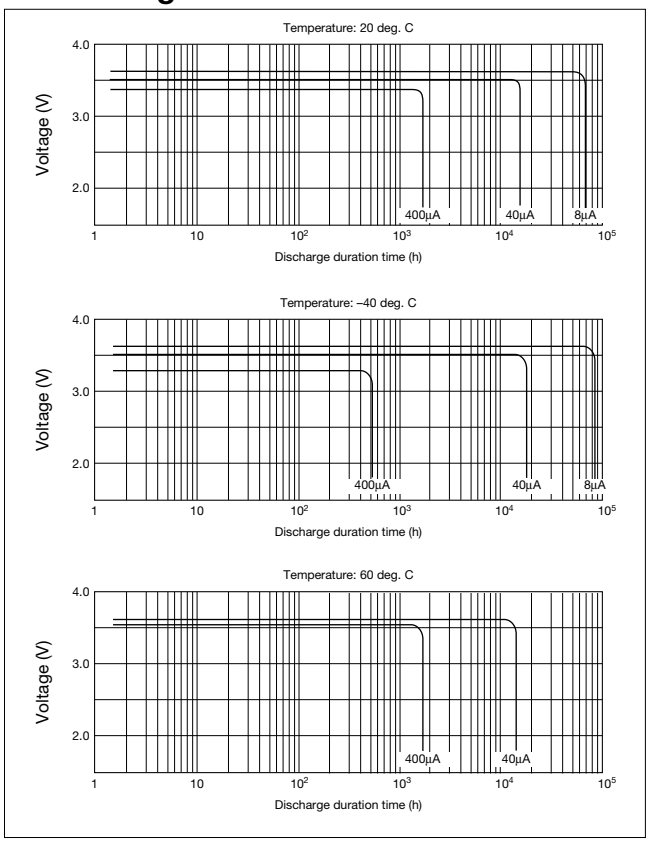


Storage Characteristics

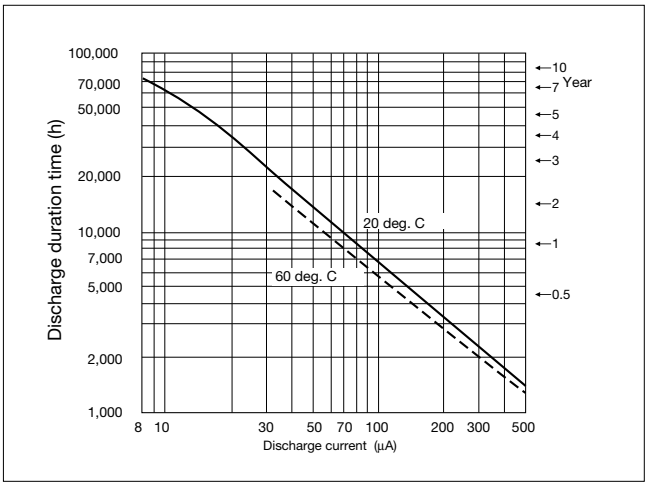


ER3S (790mAh)

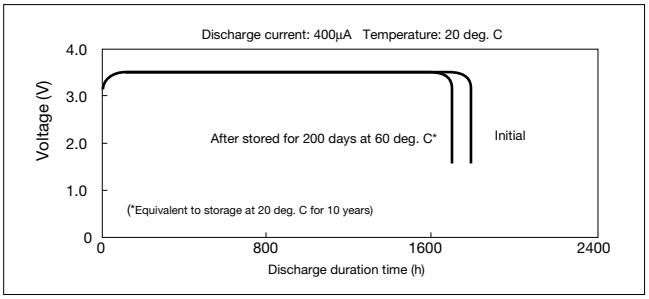
Discharge Characteristics



Relationship between Discharge Current and Duration Time

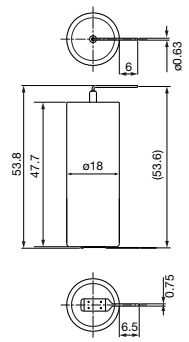


Storage Characteristics

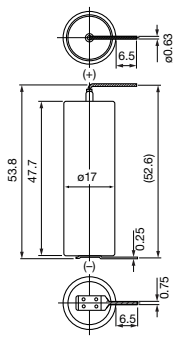


External Dimensions (unit : mm)

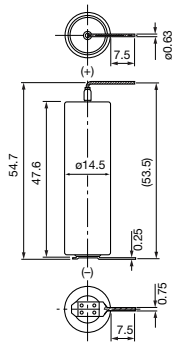
ER18/50 #2 PC



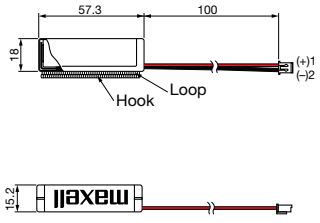
ER17/50 #2 PC



ER6 #2 PC

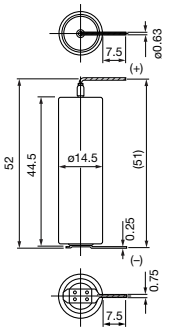


ER6K-#17

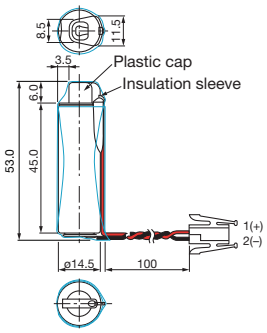


Housing: XHP-2 (JST)
Contact: SXH-001GH-P0.6 (JST)
Lead wire: AWG26

ER6C #2 PC(2)

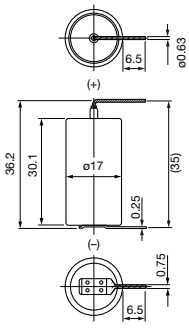


ER6C WKP

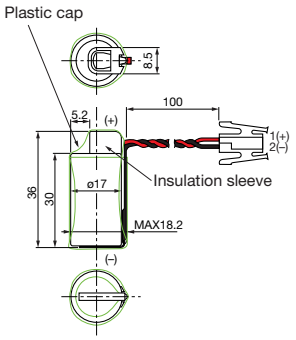


Housing: HNC-2.5S-2 (Hirose)
Contact: HNC-2.5S-C-B(0.3) (Hirose)
Lead wire: AWG26

ER17/33 #2 PC

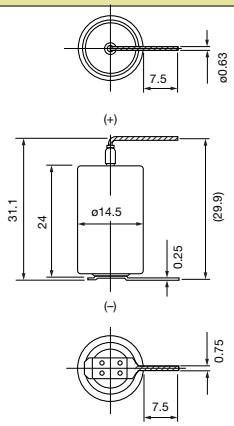


ER17/33 WKP

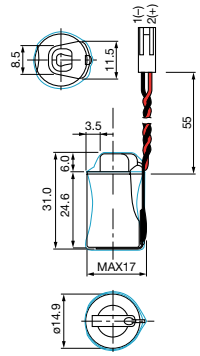


Housing: HNC2-2.5S-2 (Hirose)
Contact: HNC-2.5S-C-B(03) (Hirose)
Lead wire: AWG26

ER3 #2 PC

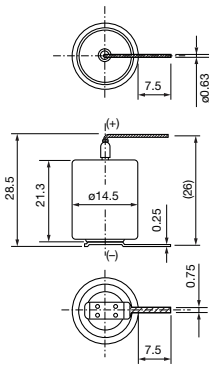


ER3 WKP

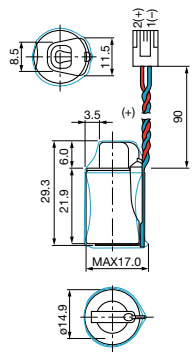


Housing: IL-2S-S3L-(N) (JAE)
Contact: IL-C2-1-1000 (JAE)
Lead wire: AWG24

ER3S #2 PC

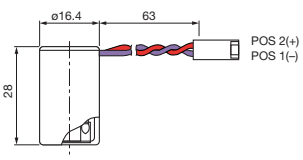


ER3S WKP



Housing: IL-S-2S-S2C2- S
Contact: IL-S-C2-1-10000
Lead wire: AWG26

ER3SR #12



Housing: 2695-02RP
Contact: 2759 GS
Lead wire: UL1007 AWG26

: Tin plating
: Horizontal & Through hole Type
: Wire connector Type

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